very similar to those found in the Swiss lakes; a vast quantity of bones of oxen (of several varieties, including *Bos longifrons*), sheep, goats, deer, swine, dogs, &c.; of shells a great abundance, especially those of the *Patella* and *Liottrina;* a very rude querne, &c. They are considered to belong to an age as remote as the Roman period, or perhaps extending even beyond it. Mr. J. Croll concludes his account of "The Boulder-clay of Caithness, a product of land-ice," and Mr. C. Lapworth his valuable paper "On the Silurian rocks of Galashiels." Mr. Croll considers that nearly the whole of the North Sea, between Scandinavia and Scotland, was filled with glacier ice at the time of the formation of the boulder-clay of Caithness; and he indicates facts in the glaciation of the Orkney, Shetland, and Faroe Islands which certainly go a long way in support of his views. It is also to this enormous extension of ice that he ascribes that of the Locss, by the daming up of the waters of the Rhine and Elbe. Mr. Croll's paper is illustrated with a map.

Annales de Chimie et de Physique. April, 1870.—This number contains a long and valuable paper by M. Berthelot on the Varieties of Carbon. He commences by pointing out the specific heats of five different kinds of carbon, and comparing them with the specific heat of the element as deduced from that of its gaseous compounds, and shows that the relations between specific heat and atomic weight are not the same as those observed in the case of other elements. He then explains his process for distinguishing and separating the varieties of carbon by treatment with nitric acid and potassic chlorate, and describes the products obtained from carbons of different origin, enumerating no less than thirteen different varieties of the element. The next two sections describe the effects of various agents on carbon, and the carbon obtained from different compounds; concluding with the observation that the kinds of carbon differ so widely in their properties, re-actions, and specific heats as almost to warrant their being considered as different elements. The four following papers are also by M. Berthelot. The first is on the oxidation of hydrocarbons by a strong solution of chromic acid, under which circumstances ethylene produces aldehyde, propylene gives acetone, amylene forms complex bodies, probably derived from an acetone, acetylene produces carbonic, formic, and acetic acids, whilst from camphene camphor is obtained. The second describes a new synthesis of phenol, by treating acetylene with fuming sulphuric acid, thus preparing acetyleno-sulphuric acid and decomposing the potassium salt with fusing potassic hydrate. It appears that at the moment of the liberation of the acetylene from the sulpho-salt three molecules condense and oxidise at the same time. The third paper is on the action of potassic hydrate on the sulphuric derivatives of the hydrocarbons, in which the author describes the products obtained from several of the sulpho-acids. He endeavoured to prepare methylene from sodic formeno-sulphate, but without success, and in consequence of the numerous experiments which he has made he thinks that chemists must give up hopes of its existence. The last paper is on a new synthesis of acetic acid by means of acetylene. The author has discovered several processes which effect this transformation. The last method is by digesting acetylenic dichloride with alcoholic or aqueous solution of potassic hydrate, when potassic acetate and chloride are formed. Acetylenic tetrachloride with alcoholic potash at 100° gives glycolic acid, and with aqueous potash at 230° oxalic acid.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, May 19.—"Spectroscopic Observations of the Sun." No. VI. By J. Norman Lockyer, F.R.S.

The weather has lately been fine enough and the sun high enough, during my available observation-time, to enable me to resume work. The crop of new facts is not very large, not so large as it would have been had I been working with a strip of the sun, say fifty miles or a hundred miles wide, instead of one considerably over 1,000—indeed, nearer 2,000 in width; but in addition to the new facts obtained, I have very largely strengthened my former observations, so that the many hours I have spent in watching phenomena, now perfectly familiar to me, have not been absolutely lost.

The negative results which Dr. Frankland and myself have obtained in our laboratory-work in the matter of the yellow bright line, near D, in the spectrum of the chromosphere being a hydrogen line, led me to make a special series of observations on that line, with a view of differentiating it, if possible, from the line C.

It had been remarked, some time ago, by Prof. Zollner, that the yellow line was often less high in a prominence than the C line; this, however, is no evidence (bearing in mind our results with regard to magnesium). The proofs I have now to lay before the Royal Society are of a different order, and are, I take it, conclusive:—

1. With a tangential slit I have seen the yellow line bright below the chromosphere, while the C line has been dark; the two lines being in the same field of view.
2. In the case of a bright prominence over a spot on the disc, the C and F lines have been seen bright, while the yellow line has been invisible.
3. In a high-pressure injection of hydrogen, the motion indicated by change of wave-length has been less in the case of the yellow line than in the case of C and F.
4. In a similar quiescent injection the pressure indicated has been less.
5. In one case the C line was seen long and unbroken, while the yellow line was equally long, but broken.

The circumstance that this line is so rarely seen dark upon the sun makes me suspect a connection between it and the line at 5015 Angström, which is also a bright line, and often is seen bright in the chromosphere, and then higher than the sodium and magnesium lines, when they are visible at the same time; and the question arises, must we not attribute these lines to a substance which exists at a higher temperature than those mixed with it, and to one of very great levity? for its absorption-line remains invisible, as a rule, in spot-spectra.

I have been able to make a series of observations on the fine spot which was visible when I commenced them on April 10th, not far from the centre of its path over the disc. At this time, the spot, as I judged by the almost entire absence of indications of general absorption in the penumbral regions, was shallow, and this has happened to many of the spots seen lately. A few hours' observation showed that it was getting deeper apparently, and that the umbræ were enlarging and increasing in number, as if a general down-sinking were taking place; but clouds came over, and the observations were interrupted.

By the next day (April 11) the spot had certainly developed, and now there was a magnificently bright prominence, completely over the darkest mass of umbra, the prominence being fed from the penumbra or very close to it, a fact indicated by greater brilliancy than in the bright C and F lines.

April 12. The prominence was persistent.

April 15. Spot nearing the limb, prominence still persistent over spot. At eleven I saw no prominence of importance on the limb, but about an hour afterwards I was absolutely startled by a prominence not, I think, depending upon the spot I have referred to, but certainly near it, more than 2′ high, showing a tremendous motion towards the eye. There were light clouds, which reflected to me the solar spectrum, and I therefore saw the black C line at the same time. The prominence C line (on which changes of wave-length are not so well visible as in the F line) was only coincident with the absorption-line for a few seconds of arc!

Ten minutes afterwards the thickness of the line towards the right was all the indication of motion I got. In another ten minutes the bright and dark lines were coincident.

And shortly afterwards what motion there was was towards the red!

I pointed out to the Royal Society, now more than a year ago,* that the largest prominences, as seen at any one time, are not necessarily those in which either the intensest action or the most rapid change is going on. From the observations made on this and the following day, I think that we may divide prominences into two classes:—

1. Those in which great action is going on, lower vapours being injected; in the majority of cases these are not high, they last only a short time—are throbs, and are often renewed, and are not seen so frequently near the sun's poles as near the equator. They often accompany spots, but are not limited to them. These are the intensely bright prominences of the American photographs.
2. Those which are perfectly tranquil, so far as wave-length evidence goes. They are often high, are persistent, and not very bright. These do not, as a rule, accompany spots. These

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* Proc. Roy. Soc. 1869, p. 354, Mar. 17.

are the "radiance" and dull prominences shown in the American photographs.

I now return to my observations of the spot. On the 16th, the last of the many umbræ was close to the limb, and the most violent action was indicated occasionally. I was working with the C line, and certainly never saw such rapid changes of wave-length before. The motion was chiefly horizontal, or nearly so, and this was probably the reason why, in spite of the great action, the prominences, three or four of which were shut out, never rose very high.

I append some drawings, made, at my request, by an artist, Mr. Holiday, who happened to be with me, and who had never seen my instrument or the solar spectrum widely dispersed before. I attach great importance to them, as they are the untrained observations of a keen judge of form.

The appearances were at times extraordinary and new to me. The hydrogen shot out rapidly, scintillating as it went, and suddenly here and there the bright line, broad and badly defined, would be pierced, as it were, by a line of intensely brilliant light parallel to the length of the spectrum, and at times the whole prominence spectrum was built up of bright lines so arranged, indicating that the prominence itself was built up of single discharges, shot out from the region near the limb with a velocity sometimes amounting to 100 miles a second. After this had gone on for a time, the prominence mounted, and the cyclonic motion became evident; for away from the sun, as shown in my sketch, the separate masses were travelling away from the eye; then gradually a background of less luminous hydrogen was formed, moving with various velocities, and on this background the separate "bombs" appeared (I was working with a vertical spectrum) like exquisitely jewelled ear-rings.

It soon became evident that the region of the chromosphere just behind that in which the prominence arose, was being driven back with a velocity something like twenty miles a second, the back-rush being so local that, with the small image I am unfortunately compelled to use, both the moving and rigid portions were included in the thickness of the slit. I saw the two absorption-lines overlap.

These observations were of great importance to me; for the rapid action enabled me to put together several phenomena I was perfectly familiar with separately, and see their connected meaning.

They may be summarised as follows, and it will be seen that they teach us much concerning the nature of prominences. When the air is perfectly tranquil in the neighbourhood of a large spot, or, indeed, generally in any part of the disc, we see absorption-lines running along the whole length of the spectrum, crossing the Frauenhofer lines, and they vary in depth of shade and breadth according as we have pore, corrugation, or spot under the corresponding part of the slit—a pore, in fact, is a spot. Here and there, where the spectrum is brightest (where a bright point of facula is under the slit) we suddenly see this appearance—an interesting bright lozenge of light. This I take to be due to bright hydrogen at a greater pressure than ordinary, and this then is the reason of the intensely bright points seen in ranges of faculæ observed near the limb.

The appearance of this lozenge in the spectroscope, which indicates a diminution of pressure round its central portion, is the signal for some, and often all, of the following phenomena:—

1. A thinning and strange variation in the visibility and thickness of the hydrogen absorption-line under observation.
2. The appearance of other lozenges in the same locality.
3. The more or less decided formation of a bright prominence on the disk.
4. If near the limb, this prominence may extend beyond it, and its motion-form will then become more easy of observation. In such cases the motion is cyclonic in the majority of cases, and generally very rapid, and—another feature of a solar storm—the photospheric vapours are torn up with the intensely bright hydrogen, the number of bright lines visible determining the depth from which the vapours are torn, and varying almost directly with the amount of motion indicated.

Here, then, we have, I think, the chain that connects the prominences with the brighter points of the faculæ.

These lozenge-shaped appearances, which were observed close to the spot on the 16th, were accompanied by the "throbs" of the eruption, to which I have before referred; while Mr. Holiday was with me—a space of two hours—there were two outbursts, separated by a space of almost rest, and each outburst consisting of a series of discharges, as I have shown. I subsequently witnessed a third outburst. The phenomena observed on all three were the same in kind.

On this day I was so anxious to watch the various motion-forms of the hydrogen-lines, that I did not use the tangential slit. This I did the next day (the 17th of April) in the same region, when similar eruptions were visible, though the spot was no longer visible.

Judge of my surprise and delight, when upon sweeping along the spectrum, I found HUNDREDS of the Frauenhofer lines beautifully bright at the base of the prominence!!!

The complication of the chromosphere spectrum was greatest in the regions more refrangible than C, from E to long past *b*, and near F, and high pressure iron vapour was one of the chief causes of the phenomenon.

I have before stated to the Royal Society that I have seen the chromosphere full of lines; but the fulness then was as emptiness compared with the observation to which I now refer.

A more convincing proof of the theory of the solar constitution, put forward by Dr. Frankland and myself, could scarcely have been furnished. This observation not only endorses all my former work in this direction, but it tends to show the shallowness of the region on which many of the more important solar phenomena take place, as well as its exact locality.

The appearance of the F line, with a tangential slit at the base of the prominence, included two of the lozenge-shaped brilliant spots to which I have before referred; they were more elongated than usual—an effect of pressure, I hold, greater pressure and therefore greater complication of the chromosphere spectrum; this complication is almost impossible of observation on the disc.

It is noteworthy that in another prominence, on the same side of the sun, although the action was great, the erupted materials were simple, *i.e.*, only sodium and magnesium, and that a moderate alteration of wave-length in these vapours was obvious. Besides these observations on the 17th, I also availed myself of the pureness of the air to examine telescopically the two spots on the disc, which the spectroscope reported tranquil as to up and down rushes. I saw every cloud-dome in their neighbourhood perfectly, and I saw these domes drawn out, by horizontal currents, doubtless, in the penumbræ, while on the floors of the spots, here and there, were similar cloud-masses, the distribution of which varied from time to time, the spectrum of these masses resembling that of their fellows on the general surface of the sun.

I have before stated that the region of a spot comprised by the penumbræ appears to be shallower in the spots I have observed lately (we are now nearing the maximum period of sun spots); I have further to remark that I have evidence that the chromosphere is also shallower than it was in 1868.

I am now making special observations on these two points, as I consider that many important conclusions may be drawn from them.

Zoological Society, May 26.—G. R. Waterhouse, V.P., in the chair. A letter was read from Mr. W. H. Hudson, C.M.Z.S., containing remarks on birds observed in and around Buenos Ayres, being the fourth communication received from this gentleman on the same subject.—Mr. R. B. Sharpe exhibited and made remarks on a specimen of a rare Asiatic bird, *Podoces panderi*, from the collection of Lord Lilford.—Professor Owen read the sixteenth of a series of memoirs on *Dinornis*, containing an account of the trachea and of some other internal organs of certain species of this genus, together with a description of the brain and some nerves and muscles of the head of *Apteryx australis*.—Dr. J. Murie read a paper on the anatomy of the Prongbuck (*Antilocapra americana*), founded on the examination of the specimen of this animal which had died in the Society's Gardens in the year 1867.—A communication was read from Dr. A. B. Meyer, containing remarks on the poisonous glands of the snakes of the genus *Callophis*, being supplementary to his paper on the same subject published in the *Monatsberichte* of the Academy of Berlin.—A communication was read from Surgeon Francis Day, F.Z.S., containing notes on some fishes from the western coast of India, amongst which were several species described as new to science.—Mr. H. Adams communicated the descriptions of some new species of land and fresh-water shells obtained by Mr. E. Bartlett in Eastern Peru, and by Mr. R. Swinhoe in China and Formosa. Mr. Adams also described two new species of land shells from Africa.

Aeronautical Society, June 3.—Mr. James Glaisher, F.R.S., in the chair. Several papers were read and illustrated by models. An instrument for ascertaining the connection between velocity and pressure, exhibited by Dr. Smyth, of Maidstone, procured the encomiums of the chairman, who stated that it was calculated to supply information that was wanting in the instrument which he had been using. In the course of discussion, Mr. A. Stewart Harrison strongly advocated the necessity of an experimental fund, whereupon the chairman asked Mr. Fred. W. Brearey, the honorary secretary, to read the minutes of a late council meeting at Stafford House, at which were present Mr. Glaisher (in the chair), Sir William Fairbairn, Bart., Mr. Brook, Mr. Wright, Mr. Wenham, Mr. Oheen, and Mr. Brearey; as follows:—Sir William Fairbairn observed that we know but little of the re-action or lifting power of various forms of screw blades in the atmosphere relative to the force employed, though such experiments might be easily tried and the data obtained. Mr. Brook was of opinion that if a successful aerial machine was to be constructed, the most simple and obvious plan was that of inclined surfaces impelled forward horizontally. The most successful experiment that he had ever witnessed was upon this principle, the motive power being a wound-up clock spring, which, as long as the power lasted, sustained the machine, and further that most large birds were capable during long periods of their flight of sustaining themselves exactly in this way. It was further remarked that we were practically ignorant of the correct laws of the sustaining power of inclined surfaces of different forms and areas, and this want of knowledge was a perpetual stumblingblock to those who were wishing to spend time and money on experiments. From the fact that, as the weight and size of birds increased, so did the relative wing area decrease, it would appear that the ratio of sustaining surface to weight or resistance was by no means in equal proportion. The Chairman stated that with respect to plane surfaces of various figures exposed to the direct impact of the wind, he had already been trying some experiments with such instruments as were at his disposal, and that by employing two anemometers at the same time, so as to be sure of comparative results, he found that the indication of force increased with the size of the surface; also in the two instruments, equal surfaces shaped into different contours gave different results. These interesting experiments, so directly bearing upon the question of aerial propulsion and resistance, were still occupying his attention; but at present he could tell us nothing from actual experiment of the resistance of inclined surfaces of various forms. It was then proposed that an experimental fund should be raised by subscription, and that a suitable and well finished anemometer should be constructed, having the means of instantly setting various plane surfaces at any desired angle, and capable of registering both horizontal and vertical force simultaneously for all degrees of inclination. The results to be published for the benefit of the Society." Upon this proposition being put to the meeting, it was carried unanimously.

Ethnological Society, June 1.—Special Sectional Meeting at the Royal United Service Institute. Prof. Huxley, F.R.S. president, in the chair.—A letter was read from Lieut. Oliver, relative to the recent destruction of a cromlech in Jersey.—Col. Lane Fox read communications from Dr. Caulfield, "On the discovery of copper celts near Buttevant, Co. Cork;" and on a supposed Ogham inscription from Rus-glass, Co. Cork.—Mr. C. Spence Bate, F.R.S., then presented an elaborate "Report on the prehistoric antiquities of Dartmoor," forming one of the series of reports being now collected by the Society, with a view to obtaining accurate information on the present condition of the megalithic monuments of this country. After noticing the physical features of the district, the author described in detail the numerous stone circles, avenues, menhirs, cromlechs, cairns, and other prehistoric monuments of Dartmoor. He suggested the idea that the stones in some of the avenues may have been erected in commemoration of the death of persons of distinction, one being added for each burial. The depressions on the summit of some of the cairns were regarded rather as indications of unfinished work than of subsequent disturbance by treasure-seekers. Evidence was adduced of the wanton destruction of the granite blocks in some of the cromlechs; and both in the paper and in the subsequent discussion attention was forcibly directed to the importance of obtaining legislative protection to these prehistoric monuments. A large series of diagrams, plans, coloured sketches, photographs, and specimens illustrated this valuable communication. The discussion was sustained by Mr. W. Morrison, M.P., Mr. Moggridge, Mr. Hyde Clarke, Mr. Black, Rev. G. St.-Clair, Dr. Campbell, and Mr. Lewis.

Chemical Society, June 2.—Prof. Williamson, F.R.S., president, in the chair. Mr. W. B. Tustin was elected a Fellow.—Prof. Odling, F.R.S., delivered a lecture "On the Platinum Ammonia compounds." Platinum combines with chlorine in two proportions, viz., with four atoms of chlorine to form platinic chloride, $Pt\ Cl_4$, and with two atoms of chlorine to form platinous chloride, $Pt\ Cl_2$. All the platinum ammonia compounds are produced in first instance from the plantinous chloride, none of them directly from the platinic chloride. If this is borne in mind, a great simplicity will at once be introduced into the study of the platinum ammonias. Next, the lecturer proceeded to show the manifestations of the atomicities of nitrogen, boron, silicon, and platinum as illustrated in the compounds $NH_3\ HCl$, $BF_3\ KF$, $SiF_4\ K_2\ F_2$, and $Pt\ Cl_4\ K_2Cl_2$, which four compounds are decidedly analogous, and deduced from this as well as from many other evidences the necessity of writing the formula of sal-ammoniac $NH_3\ HCl$, and not $NH_4\ Cl$. Having established this, the metallic derivatives of sal-ammoniac were ranged into two sets—those in which the metal can be detected by the usual tests, and those in which this cannot be done; the first may be typified by the formula $NH_3\ m\ Cl$, the second by $NH_2\, m\ HCl$. [The small letter indicates that quantity of a metal which occupies the place of one atom of hydrogen.] The lecturer then extended his comparison of the manifestations of the pentad nature or the pendacity of nitrogen with those of the tetradicity of carbon, and concluded this kind of preface by reminding of the necessity of studying mineral chemistry in the light of organic chemistry. He then gave a short history of the platinum ammonia compounds, beginning with the so-called green salt of Magnus discovered in 1828, mentioning the salts prepared and described by Gros, Reiset, Peyronne, and others, and finally by stating Laurent and Gerhardt's latest arrangements for classifying these compounds. That classification is now by no means satisfactory, and Dr. Odling hopes to bring forward at some future meeting his own views on this subject.

Anthropological Society, May 31.—Dr. R. S. Charnock, vice-president, in the chair. Mr. George Thorne Ricketts, Her Majesty's consul, Manila, was elected a Fellow.

A paper by Dr. John Shortt was read on "The Armenians of Southern India." Early in the sixteenth century a few Armenians found their way into Southern India with the countenance and support of the Hon. East India Company, and under a contract with the company equal privileges with British subjects were conceded to the Armenians. The company further extended favours to them when they reached, in any town, the number of forty, by the provision of a place of worship, and by annual grants of money. For a long time after their arrival in India they avoided mingling with other people, but latterly that rule has been broken through, and alliances in marriage with Europeans are not unfrequent. The Armenians have diminished in numbers, and, it is said, are daily decreasing in influence. The chief causes of their approaching extinction in India appear to be the vice of intemperance, the taint of disease, and the contact with Europeans, more especially the English. The physical and moral characteristics were described; in the former it was stated that the Armenians are strongly allied to the Jewish race, from which they claim descent.

A paper by Mr. John Stirling, M.A., was read on "The Races of Morocco." The inhabitants of that part of Barbary known as Morocco may be arranged under the following heads, viz, Berbers, Al-Ryf, Arabs, Bohára troops, and other Negroes or half-breeds, and Jews. The word *Kabyles* often erroneously used to designate some North African race, is a term applied by the Moors to distinguish villagers or country people engaged in agriculture. The Berbers are probably of Phœnician blood mixed with an old race indigenous to Morocco; at any rate, the remains of dolmens and other monuments would point to that origin. The Al-Ryf are wild descendants of the Ryf pirates, the inhabitants of the northern spurs of the Atlas range which separates Morocco from Algeria. The Al-Ryf are comparatively a fair people, and such of them as follow in-door occupations exhibit a delicate olive complexion. The Bohára troop form a remarkable race; their ancestors were a rebellious Negro tribe living south of the Atlas. They have married with Moorish women, but still retain to a great degree the Negro aspect. The Negroes of Morocco have intermarried with the fair Moors, and produced a mixed race. The true Moors are fair, some individuals having blue eyes and light or red hair.

Sir Duncan Gibb, Bart., M.D., in a paper "On the Paucity of Aboriginal Monuments in Canada," attributed the absence in

Canada of monuments built of stone to the peculiar character of the climate, which would be unfavourable to their preservation. He anticipated the discovery some day of traces of the ancient inhabitants in the great caverns north of Flamborough, and in the island of Anticosti.

Institution of Civil Engineers, May 17.—Charles B. Vignoles, F.R.S., president, in the chair. The paper read was "On recent improvements in regenerative hot-blast stoves for blast furnaces," by Mr. E. A. Cowper, M. Inst. C.E. The author stated that when, in 1828, the late Mr. J. B. Neilson, M. Inst. C.E., introduced the plan of heating the air employed as blast, by means of iron pipes placed in or near a fire, the increase of temperature was at first only from 60° to 100° Fahr. Subsequently, Mr. Neilson obtained a temperature of 600° or 650° and the pipe stoves had since been urged up to 900°, and in a few cases to 1·00°. The wear and tear, however, with such temperatures of blast were considerable; there was great loss of heat by conduction, and the pipe stoves were, as a rule, worked in a leaky condition, necessitating the expenditure of engine power for blowing air uselessly. The improvements described in the paper were based upon Mr. Siemens' regenerative furnace. Each stove of a pair consisted of a wrought-iron cylindrical casing, lined with fire-brick, and provided with a central shaft or flue, which extended to within a few feet of the brick dome forming the top. Around this shaft there were a number of compartments, or boxes, formed of bricks so placed that those in one course were not exactly coincident in position with those in the courses either above or below, though a passage was left open from the bottom to the top of the mass of brickwork. This wrought-iron casing was provided with several valves, three being for the cold blast, of gas, and of air for combustion, and two being for the exit of the hot blast and of the products of combustion. When a stove had been at work heating blast, and it was wanted to reheat it, the first thing to be done was to put another stove in operation, then to shut the hot and the cold blast valves, allowing the air in the stove to be blown out at a small valve to reduce it to atmospheric pressure. The gas, air, and chimney valves were next opened, and the gas, igniting as it entered, gave a large volume of flame right up the central shaft and over and into the regenerator, thus heating the top course of brickwork considerably, the next course rather less, and so on, the products of combustion passing away to the chimney at a temperature of about 300°. In the course of a few hours a large amount of caloric was stored up in the bricks forming the regenerator, a good red heat penetrating nearly to the bottom, when the stove was again ready to heat the blast to a temperature of 1,400° or 1,500°. In these stoves the cost of dust catchers was avoided, and the expense of producing gas was also saved, as the gas was used direct from the top of the blast furnace, and the stoves could be cleaned out with the greatest facility. The construction of the regenerator in compartments or boxes, connected together vertically but not horizontally, gave the power of applying the blast with efficiency (inasmuch as the whole force of the blast was confined to the one passage that was being blown at the time), and admitted of a brush being passed up or down the boxes to remove the dust. The form and proportion of the passages had been found, after numerous experiments, to produce an excellent effect in mixing the air, thereby ensuring a rapid and perfect conduction of heat from the bricks to the air, or *vice versa*, from the products of combustion to the bricks. The results obtained by Messrs. Cochrane from the adoption of these stoves at Ormesby, as regarded the quality of iron, the increased make, and the saving of coke in the blast furnace, had been most satisfactory. Thus there was a saving of 4 cwt. of coke per ton of iron produced, by the use of the regenerative stoves for heating the blast, when compared with good cast-iron pipe stoves, and the saving was still more over ordinary pipe stoves. With a large furnace, producing 475 tons a week, the first cost of these stoves was somewhat less than the cost of pipe stoves, while the expense of working was less, so that the profit, taking everything into account, was estimated to amount to about 4,162*l.* a year.

CAMBRIDGE

Philosophical Society, May 16.—Professor W. Cayley, president, in the chair. The following communications were made to the Society:—

(1.) By Mr. Sedley Taylor (Trinity). Mr. Taylor described the nature and classification of musical sounds, their laws and connection, and illustrated experimentally the subject of "beats," and explained at some length, with illustrations, Helmholtz's theory of harmony. The rest of the paper was devoted to a criticism of a theory of consonance given by Professor Tyndall in his published lectures on sound. This theory, he maintained, was, while professing to be that of Helmholtz, a totally different one, in flat contradiction to the facts of experience, and in reality wholly erroneous.

(2.) On a case of asymmetry in the human body, by Professor Humphry. The subject of this paper was a female patient in Addenhook's Hospital, at Cambridge. The asymmetry was very marked, carried out through the whole body; the right arm, for example, being more fully developed, and 2½ inches longer than the left, and extending even to the mammary glands, teeth, tonsils, &c. The subject had always enjoyed good health, was strong, and fully developed. No paralysis had ever been produced by this asymmetry, as had been the case in the instance mentioned by Van der Kolb, a cast of the brain of which was exhibited. Professor Humphry expressed himself wholly unable to account for this instance. As the person was alive and well, of course examination of the internal organs was impossible.

PARIS

Academy of Sciences, June 6.—A considerable number of works and memoirs were received in candidature for various prizes in the gift of the Academy.—M. Chasles presented a note by M. Mannheim, "On the determination of the osculatory plane and radius of curvature of the trajectory of some point in a straight line, which is displaced under certain conditions;" and also a note by MM. F. Klein and S. Lie, "On a certain family of curves and surfaces."—A note was read by M. Des Cloiseaux, "On the optical properties of benzile, and of some bodies of the camphor family, in the crystallised state and in solution." The author has found that crystals of benzile rotated the plane of polarisation in different ways, and the right and left crystals, when dissolved and crystallised two or three times, likewise gave a mixture of crystals with opposite rotations. Solution of benzile in ether has no action on polarised light. Benzile thus possesses optical properties similar to those of periodate of soda. Common camphor in solution deviates the plane of polarisation, whilst its crystals have no action upon polarised light. Camphor of patchouli and mint camphor (menthole), both belonging to the hexagonal system, have a negative, uniaxial, double refraction, and their solutions in alcohol deviate the plane of polarisation to the left. Three camphors belonging to the cubic system, namely, Bornean camphor, terecamphene, and monohydrochlorate of turpentine, have no action on polarised light when crystallised, but in solution strongly deviate the plane of polarisation, the first to the right, the other two to the left.—M. Duchemin described a marine galvanic battery, set in action by contact with sea water. It consists of a thick cylinder of zinc, pierced with holes, and containing a porous vessel, enclosing a carbon element surrounded by powdered coke and perchloride of iron.—An extract of a letter from Father Secchi to M. Fizeau, "On the displacement of the lines observed in the solar spectrum," was read. M. Le Verrier communicated an extract from a letter of M. Winnecke announcing his discovery of a new telescopic comet on the night of the 29-30th May, at Carlsruhe.—Mr. H. Sainte-Claire Deville communicated a second memoir on the action of water on iron and of hydrogen on oxide of iron. In this paper he described his experiments with iron at temperatures of 150°, 265°, 440°, 860°, and 1040° C. (= 302°, 509°, 824°, 1580°, and 1904° F.) and with aqueous vapour at constant and varying tensions.—A paper was read by M. E. Frémy on the reduction of nitrous acid by metals, containing the continuation of his researches on this subject brought under the notice of the Academy on the 10th January (see NATURE, No. 12). He identified the body obtained by the reduction of nitrous acid and the nitrites with the oxy-ammonia of M. Lossen, NH^3O^2 (or NH^2O, HO) and stated that it possessed marked basic properties, and is strongly reductive.—M. de Quatrefages presented a note by M. E. Perrier on the circulation of the Oligochæta of the group Naïdæ, which he described from researches made upon *Dero obtusa*. The circulatory apparatus in this worm consists, according to the author, of a dorsal and a ventral vessel, united by a most complex vascular apparatus which varies considerably in its structure in different regions of the body.—A note by M. Feltz, on the phenomena of which the white globules of the blood, and the walls of the capillary vessels, are the seat during inflammation, was communicated by M. C. Robin.—M. R. Wolf suggested that instead of applying the decimal mode of division to the quadrant of the circle and the quarter of the day, as proposed by M. D'Abbadie, the whole circle and the whole day should be taken as the unit of division. M. D'Abbadie remarked that the quadrant is the natural unit which has always been adopted for trigonometrical purposes, and indicated some practical inconveniences which would result from a change. Of the remaining communications only the titles are given.

Boston

Natural History Society, *Section of Microscopy*, Feb. 9.—Dr. B. Joy Jeffries in the chair. The following paper was read:—"Notes on Diatomaceæ," by Professor Arthur Mead Edwards. "A few days since (Sept. 1869) I made a gathering in a ditch communicating with the salt water of the Hudson River, opposite the city of New York, at Weehawken, N. J. Of course the water in the ditch was salt, and, in fact, in it last spring I had caught specimens of Stickleback (*Gasterosteus*) which had come up there from the river to spawn, as is their wont to do. The Ten-spined Stickleback (*G. pungitius*) I had found very plentiful, and mixed with it a few individuals of the Three-spined (*G. aculeatus*); in fact these fish occurred in such numbers that when the water became foul, as it did by evaporation, the bottom of the ditch was literally covered with their dead bodies. The gathering, however, I have to speak of at the present time was made for the purpose of procuring Diatomaceæ, and consisted of specimens of an alga belonging to the genus *Enteromorpha*, having attached to it more or less firmly numerous Diatomaceæ and animals. The commonest form of Diatom was a *Cyclotella*, and seemingly fixed in some manner to the *Enteromorpha*, for it was not shaken off by pretty rough usage. How it was fixed I could not detect; most likely by means of a mucous envelope of such tenuity that it is not readily seen. The next most common form is the truly wonderful, inexplicable *Bacillaria paradoxa*, the paradoxical bundle of sticks. Often and often have I spent hours looking at this marvel of nature; the motion without apparent cause or mode, an invisible joint which, as a friend of mine, an engineer, once remarked, would be a fortune to any one who would discover it, for here we have several sticks forming the bundle, moving over each other without separating, and yet the use of the highest powers of the microscope has failed to detect the means of their union into one mass or composite group of individuals. This grouping of individuals together, which we so commonly find among the Diatomaceæ, as in *Schizonema*, *Achnanthes*, *Melosira*, and a host of other genera, appears to me to have its analogue in the animal kingdom in the Polyzoa; which, although generally fixed, yet at certain periods throw off motile forms by means of which the species is distributed. Do not the Diatomaceæ do likewise? I am of opinion that they do, and I shall produce evidence on that point further on. As to the *Bacillaria paradoxa*, the oftener I watch it the more it puzzles me. Not long since I saw one specimen (of course I mean one bundle of individuals) slide out to its utmost limit across the field of view, and then, becoming entangled with two others, which likewise were made up of many individuals, some eight or ten of its frustules (as the complete individuals are called) were twisted around almost off from the rest, so as to lie at right angles to them, and when the group containing the largest number of frustules receded to their former position, which they soon did, the eight or ten seeming by the act of twisting to lose their power of motion among themselves for the time being, were dragged along in a helpless condition, and twisted completely around one revolution, so as thereafter to fall back again into their places, when all went on as usual. That is to say, the regular motion of all the frustules over each other succeeded. Now what kind of a joint can it be that permits of such eccentric movement? As I have already said, I am more puzzled than ever. Along with the *Bacillaria* in the brackish water at Hoboken, I found numerous individuals of an *Amphora*, which I have known in this neighbourhood for many years, and which I considered unnamed as yet. To it I have given the provisional name of *A. lanceolata*, on account of the form of its outline. This genus has always been considered an epiphytaceous one; that is to say, one which grows attached to other plants or submerged substances, yet this form was free and in active motion. In fact I think it was one of the most lively Diatoms I ever saw. So another small species of *Amphora* which is common near here, is always, as far as I have noticed, free. Here we have species appearing both in the free and attached conditions, and this is even more strikingly illustrated in *Schizonema*. *Bacillaria paradoxa* is usually set down as the most rapid in motion of the Diatomaceæ, its velocity being recorded by Smith, as he measured it, at over one two-hundredth of an inch in a second. This is certainly pretty quick when we consider that the length of the frustule is only ·0025 of an inch. But my experience has been that its velocity varies in every degree from that mentioned to perfect rest; at times some individuals will be in rapid movement, while others are motionless; and also I have remarked that from sunrise to noon seems to be the period during which, under ordinary conditions, the movement is most active, while during the afternoon it is very sluggish, and at night almost *nil*. This *Amphora*, as I saw it at the time mentioned, was moving even more rapidly than I ever saw a *Bacillaria* move, and that with a steady onward progression very different from that of most naviculiform diatoms. Many months since I mentioned at one of the meetings of the Lyceum of Natural History in New York, that I had seen two apparently different genera of Diatoms existing within the same investing tube; and now I wish to place that fact upon record, and to state one or two more instances of the same mode of growth. During the month of March 1868, I found in the harbour of New York specimens of *Schizonuma Grevillei* in active motion within their investing tubes, but accompanied by a much smaller form possessing a totally different outline from *S. Grevillei*, being blunter at the ends, and with parallel sides. During the same month, and also in April, I found this mode of occurrence very common, and also *Schizonema Grevillei* and a *Homœocladia* in the same tube, and *Schizonema cruciger* and the small form mentioned above, both in the same tube, and *S. cruciger* and *Grevillei* in the same tube. In all these cases the frustules were in lively motion, passing over each other from one end to the other of the tube. In May of the present year, 1869, I found growing in the salt water of the 'Mill pond' at Salem, Mass., *Schizonema cruciger* and *Nitzschia closterium*, W. S. (*Ceratoneis closterium*, C. G. E., and *Nitzschiella closterium*, L. R.), both in the same tube. And here it will be necessary to say something in regard to the form I have called *Nitzschia closterium*, as I shall thereby, I hope, be enabled to clear away a little fog of synonyms. Neither Smith, Kützing, nor Rabenhorst describes or figures any species living within a tube like *Schizonema*, the frustules of which have an outline and markings similar to *Nitzschia closterium*, so that it is not likely that they ever saw anything but the free form or condition of this species. However, Ehrenberg figures and describes, under the designation of *Schizonema? Agardhii* (*Die Infusionsthierchen*, 1838, p. 343, t. xx. fig. xvi.), a form agreeing with this, but the structure of the frustule is that of *Nitzschiella* of Rabenhorst, so that the specific name of this species should be *Agardhii*, whatever its genus be decided to be hereafter."

March 2.—Dr. C. T. Jackson, vice-president, in the chair. The following papers were presented:—"Description of the Larva and Chrysalis of *Papilio Rutulus* Boisd., of California," by Samuel H. Scudder.—"On the Phosphate Beds of South Carolina," by N. S. Shaler. The latter contains a partial account of the observations made upon this district by the author, while in the employ of the United States Coast Survey, and is published with the permission of the Superintendent of the Survey, Prof. Benj. Pierce, of Cambridge. A portion of the conclusions have a certain commercial as well as scientific value, and it was deemed by the Superintendent desirable to place them before the public at the earliest opportunity. The remainder of the description of these beds will be found in the report of the work of the Coast Survey for 1870.

March 16.—Mr. William T. Brigham in the chair. The following papers were presented:—"Note on the Occurrence of *Euleptorhamphus longirostris* on the Coast of Massachusetts," by F. W. Putnam.—"Revision of the Classification of the Mollusca of Massachusetts," by W. H. Dall, Smithsonian Institution.

New York

Lyceum of Natural History, *Chemical Section*, May 9.—Prof. Charles A. Seely "On the Constitution of Ammoniacal Amalgam." Ammonium amalgam was discovered by Berzelius in 1808; and immediately after by Pontin, Seebeck, and Trommsdorff. Its easy preparation, singular properties, and its relation to current theories, have made it familiar to all chemists. It led to the adoption of Ampere's ammonium theory, gave a great impetus to the theory of organic radicals, and revived the notions of the alchemists of the compound nature of metals. Early in this century it led many to conclude that the base of nitrogen is a metal; and at the present time, without doubt, has assisted in giving currency to the notion that hydrogen is a metal. Except for it, perhaps the crudity, hydrogenium, would not have been inflicted upon us. Of course it has occupied a conspicuous place in chemical literature; scoresof papers, and at least two books, have been printed about it. The name ammonium amalgam expresses the supposed constitution of the substance; the radical ammonium is represented as dissolved in or united with mercury. The ammonium is, moreover, conceded to be a solid or a liquid, and to have a truly metallic character. Thus the latest and best authorities present the case. It is described, in nearly all treatises on chemistry, as if its constitution was as certainly ascertained as that of common salt. There have been from the beginning, however, those who doubted the prevailing ideas, and some (see Daniel's "Chemical Philosophy," p. 520, and Dr. Wetherill on Ammonium Amalgam, in *Silliman's Journal*, vol. x., p. 160) boldly objected to them, but the reasons they alleged had not sufficient weight. Ammonium amalgam has always been a pet with chemists; it has always been ready for the service of one theory or another. The ammonium theory, the radical theory, the nitrogen and hydrogenium theories, have each in their turn been of too much importance to permit any of their props to be withdrawn.

The author considers the so-called ammonium amalgam to be a mechanical or physical mixture of liquid mercury with the gases ammonia and hydrogen, and that its semi-solid consistence is due to the mixture having the nature of a froth. When sodium-amalgam is brought into a solution of sal-ammoniac (the ordinary method of preparing ammonium amalgam) the chlorine combines with the sodium, and the residue ($NH_3 + H$) of the sal-ammoniac is set free all over the surface of the mercury. The particles of the mixed gases adhere to the mercury, and by reason of the movement bringing to the surface fresh mercury, they become enfilmed and carried inward, until the mixture becomes a homogeneous froth. The principal considerations by which this view of the constitution of ammonium amalgam has been reached, are as follows:—

1. The volume of ammonium amalgam is inexplicable in any other way; it is utterly inconsistent with the well-established laws of combinations by volume. There is no case of a liquid or solid chemical compound, or amalgam, which has any analogy to it.

2. Mercury has a mirror-like surface, while ammonium amalgam has comparatively a whiter and more dead surface; it approaches in appearance to matt silver. Such changes are characteristic of froths.

3. If ammonium amalgam be subjected to varying pressure, its volume changes apparently in accordance with Mariotte's law of gaseous volume. To illustrate this important fact, a glass tube one-third inch in diameter, twenty inches long, and fitted with a plunger, was employed. Mercury containing a little sodium was poured into the tube to one-third of an inch in depth, and upon this was poured a strong solution of chloride of ammonium, occupying about two inches in length of the tube. The ammonium amalgam was completely formed in a few minutes, and occupied several inches of the tube. On adjusting and depressing the plunger, the volume of the amalgam progressively diminished till it closely approached the original volume of the amalgam. Also it was notable that the amalgam progressively gained fluidity and the mirror surface, till at the greatest pressure it appeared like mercury. On withdrawing the pressure the original volume and appearance of the compound were resumed, and on reducing the pressure below that of the air, the amalgam still expanded, until it rose above the surface of the liquid in the tube. If the great pressure be maintained, more ammonium amalgam will be formed, the mass expanding progressively, apparently in accordance with the fact that the absorption or adhesion of gases to liquids is favoured by pressure. By means of the simple apparatus used a pressure of ten atmospheres, or a good vacuum, is easily and at once attainable, and the experiments with it are very striking.

The so-called ammonium amalgam is therefore not an amalgam at all; ammonium is not proved to be a metal, and if it be admitted that the monatomic radical really exists in ammonium amalgam, it is neither a solid nor a liquid, but a gas.

The considerations regarding ammonium amalgam are evidently equally applicable to Loew's hydrogenium amalgam; both are only metallic froths. The expansion of palladium observed by Graham, on its absorption of hydrogen, is probably analogous to the case in question. In both cases the gases concerned are condensed by reason of their attraction to the metal; and if the molecules of palladium were made free to move, as those of mercury, it is probable that Graham's hydrogenium alloy would become a palladic froth, more remarkable than the corresponding mercuric froth. Many have erroneously supposed that hydrogen was conspicuous in its capability of being absorbed by metals, and thus have more readily been infused with the hydrogenium theory. Oxygen has an eminence over hydrogen in that property, and yet no one has a theory of oxygenium. Iron absorbs carbonic oxide, but no one is bold enough to suggest that carbonic oxide is a metal.

DIARY

THURSDAY, June 16.

Royal Society, at 8.30.—Papers to be read by Dr. Hofmann, F.R.S.; Dr. H. E. Armstrong, Dr. Alex. Rattray, Prof. Macalister, C. Tomlinson, F.R.S., W. Huggins, F.R.S., Sir Edward Sabine, P R.S., the Earl of Rosse, F.R.S., Dr. Stenhouse, F.R.S., G. Busk, F.R.S., the Hon. J. W. Strutt, Mr. J. Broughton, Mr. A. Le Sueur, and W. H. L. Russell, F.R.S.

Royal Society of Antiquaries, at 8.30.—On Heydon Church, Yorkshire: Mr. G. E. Street.

Linnean Society, at 8.—On two Species of Serapias which occasionally present semi-labelliform lateral sepals: Mr. J. T. Moggridge.

Chemical Society, at 8.

Numismatic Society, at 7.—Anniversary Meeting.

SUNDAY, June 19.

Sunday Lecture Society, at 8.—On Volcanoes: Mr. D. Forbes.

MONDAY, June 20.

London Institution, at 4.—Botany: Prof. Bentley.

TUESDAY, June 21.

Statistical Society, at 8.—On Free Libraries: Mr. W. E. A. Axon.

Ethnological Society, at 8.30 (at the Royal United Service Institution, Whitehall Yard).—On the Aymara Indians of Bolivia and Peru: Mr. D. Forbes.

WEDNESDAY, June 22.

Geological Society, at 8.

THURSDAY, June 23.

Zoological Society, at 8.30.—On the Walrus: Dr. J. Murie.—Catalogue of the Mammals of South China and Formosa: Mr. R. Swinhoe.—On a Collection of Birds from the Island of Trinidad: Dr. O. Finsch.

BOOKS RECEIVED

English.—On Diamagnetism and Magne-Crystallic Action: Prof. Tyndall (Longmans and Co.).—Notes on Light: Prof. Tyndall (Longmans and Co.).—Grave-mounds and their Contents: L. Jewitt (Groombridge and Sons).—Gymnastics for Ladies: Madame Brenner.—First Principles of Chemical Philosophy: J. P. Cooke, jun. (Macmillans).

Foreign.—(Through Williams and Norgate).—Annales de Chimie et de Physique: Chevreul et Dumas, Tome xx.—Zeitschrift für Ethnologie, 1870, Heft II.—Ueber die Entstehung der Welt: C. S. Cornelius.—Lehrbuch der Chemie: A. Genther.—Histoire des Poissons: Aug Duméril. Tome ii. et Atlas.—Charles Darwin et ses précurseurs francais: A. de Quatrefages.

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